What is claimed is:

1. A layer-by-layer etching apparatus using a neutral beam, the layer-by-layer etching apparatus comprising:

a reaction chamber having a stage therein on which a substrate to be etched is mounted;

a neutral beam generator for generating a neutral beam from a source gas to supply the neutral beam into the reaction chamber;

a shutter installed between the neutral beam generator and the reaction chamber, the shutter for controlling the supply of the neutral beam into the reaction chamber;

an etching gas supply for supplying an etching gas into the reaction chamber;

a purge gas supply for supplying a purge gas into the reaction chamber; and

a controller for controlling the supply of the source gas, the etching gas, and the purge gas and the opening and closing of the shutter.

2. The layer-by-layer etching apparatus of claim 1, wherein the neutral beam generator comprises:

an ion source for extracting an ion beam having a predetermined polarity from the source gas and accelerating the ion beam; and

a reflector positioned in the path of an ion beam accelerated from the ion source, the reflector for reflecting and neutralizing the ion beam.

3. The layer-by-layer etching apparatus of claim 2, wherein the reflector is formed of a plate which may be tilted to control an angle of incidence of an incident ion beam to the horizontal surface of the plate.

4. The layer-by-layer etching apparatus of claim 2, wherein the reflector is formed of a plurality of overlapped cylindrical reflectors and different polar voltages are applied to adjacent reflectors of the overlapped cylindrical reflectors.

5. The layer-by-layer etching apparatus of claim 2, wherein the reflector is one of a semiconductor substrate, a silicon dioxide, and a metal substrate.

6. The layer-by-layer etching apparatus of claim 2, wherein the ion source is one of a high-density helicon plasma ion gun and an ICP-type ion gun.

7. The layer-by-layer etching apparatus of claim 1, wherein the substrate to be etched is a substrate containing silicon, the neutral beam is an argon neutral beam, and the etching gas is a chlorine gas.

8. A layer-by-layer etching method using a neutral beam, the layer-by-layer etching method comprising:

(a) loading a substrate to be etched, on which a layer to be etched is exposed, on a stage in a reaction chamber;

(b) supplying an etching gas into the reaction chamber to adsorb the etching gas on the surface of an exposed portion of the layer to be etched;

(c) removing excessive etching gas remaining after being adsorbed;

(d) irradiating a neutral beam on the layer to be etched on which the etching gas is adsorbed; and

(e) removing etch by-products generated by the irradiation of the neutral beam.

9. The layer-by-layer etching method of claim 8, wherein steps (b) through (e) forms one cycle which is repeatedly performed to etch the layer to be etched from the surface of the layer in a layer-by-layer manner.

10. The layer-by-layer etching method of claim 9, wherein a monoatomic layer distributed on the surface of the layer to be etched is etched by half whenever the cycle is performed one time.

11. The layer-by-layer etching method of claim 8, wherein in step (d) acceleration energy of the neutral beam is controlled so that sputtering does not occur on the surface of the layer to be etched.

12. The layer-by-layer etching method of claim 11, wherein the acceleration energy of the neutral beam is controlled to be 50 eV or less.

13. The layer-by-layer etching method of claim 8, wherein the layer to be etched is a material layer containing silicon, the etching gas is a chlorine gas, and the neutral beam is an argon neutral beam.

14. The layer-by-layer etching method of claim 8, wherein steps (c) and (e) are performed using a nitrogen gas as a purge gas.

15. The layer-by-layer etching method of claim 8, wherein in step (d), the neutral beam is irradiated from an ion source for extracting an ion beam having a predetermined polarity from a source gas and accelerating the ion beam and a neutral beam generator having a reflector which is positioned in a path of the ion beam accelerated from the ion source and reflects and neutralizes the ion beam.